Hazard Reduction Through Development Management in Hurricane-Prone Localities: State of the Art

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The state of the art in using development management strategies to reduce hurricane hazards is explored through a 1984 survey of hurricane-prone localities in 19 states. Contrary to some of the hazard mitigation literature, results show not only a high priority for hazard mitigation but also a high reliance on development management approaches, as compared with building, strengthening, and environmental alteration.

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Until recently, the plans and programs employed by coastal communities to help mitigate hurricane and severe storm impacts have been poorly documented. Our research seeks a better understanding of local hazard mitigation measures and their effectiveness in reducing storm threats. To gather information, we mailed a questionnaire to planners and public officials in high-hazard coastal localities in nineteen states.

The questionnaire asked:

1. What types of programs and measures (including development management) are currently employed by coastal localities to reduce hurricane and storm hazards?
2. How effective are these programs and measures at reducing storm hazards?
3. What are the major characteristics and attributes of coastal development, and what are the factors which influence these patterns?
4. What are the major factors which influence the political feasibility and acceptability of hazard mitigation measures, and specifically development management?
5. What are the factors which influence the effectiveness of mitigation programs and measures, and specifically development management?

This article synthesizes information from the survey findings.[1] Among the highlights of these findings are:

- a surprisingly high priority for hazard mitigation;
- a surprisingly high number of adopted storm hazard reduction strategies;
- a surprisingly high degree of operating development management programs;
- a reasonably high effectiveness rating for overall reduction efforts.

Survey Population

The questionnaire was designed to document mitigation efforts of coastal areas most susceptible to hurricane and coastal storm forces. Rather than select localities according to some subjective assessment of hurricane risk, we decided that an objective selection could be appropriately based on "Velocity-Zone" or "V-Zone" designations provided by the Federal Emergency Management Agency (FEMA) under the National Flood Insurance Program (NFIP). V-zones are coastal waterfront areas which are of sufficient fetch to support a minimum three-foot wave atop the still flood waters (see U.S. Army Corps of Engineers, 1975). In these areas, higher actuarial flood insurance rates apply and special building provisions are required under NFIP.

All localities of over 1,000 population containing V-zones were surveyed. The population was determined from the FEMA "communities file," supplemented by a FEMA listing of localities currently being studied for V-zone designation.[2] Questionnaires were mailed to 636 localities in 18 Gulf and Atlantic coast states

mitigate storm and hurricane impacts

velocity zone designations

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(Alabama, Connecticut, Delaware, Florida, Georgia, Louisiana, Maine, Maryland, Massachusetts, Mississippi, New Hampshire, New Jersey, New York, North Carolina, Rhode Island, South Carolina, Texas, Virginia). In addition, the four counties in Hawaii were included.

Each locality containing V-zones received a questionnaire in June, 1984. As of December 1, 1984, 420 survey responses had been received, for a response rate of 66%.[3]

Respondent Characteristics

characteristics of hurricane-prone localities

Information from the questionnaire provides useful insights into a number of important characteristics of hurricane-prone localities. Important highlights include:

- The predominant type of *existing* development within the floodplains of hurricane-prone survey communities is single-family detached residential. Assessments of *new* development indicate that a high degree of multi-family and commercial construction (including commercial, recreational and hotel/motel is sited in coastal floodplains.
- In a significant number of the communities surveyed (over one-third), *hazard-free development sites* (sites outside of the 100-year floodplain) were considered to be either scarce or very scarce.
- More than half of the survey respondents (57%) did not know how long it would take to *evacuate* their communities should a hurricane threaten. About one-half of these respondents were located in jurisdictions of less than 20,000 in population.
- The majority of respondents were at least somewhat familiar with *state programs* assisting localities in storm hazard management. Most had received some type of state assistance in the past five years, with information on the National Flood Insurance Program and floodplain maps being the most frequent types of assistance. One-half of the respondents also indicated that their communities had received assistance with disaster preparedness plans.
- In over half of the communities, a *regional agency* had been involved in storm hazard mitigation. The most frequent type of involvement was the preparation of a regional evacuation plan.

storm hazard reduction strategies

Storm Threat Priority

The survey results challenge previously held perspectives on the local political salience of hurricane hazards. Current literature describing the politics of natural hazards discount their relative importance to public officials (e.g. Rossi, Wright and Weber-Burchin 1982; Drabek, Mushkatel and Kilijanek 1983). We expected similar results from our questionnaire. Overall, however, approximately 72% of the respondents indicated that their jurisdiction's governing body considered the threat of severe coastal storms of at least medium priority in comparison with other local issues. Close to half of the respondents (46%) indicated the priority to be of either high or very high priority. (Table 1)

Table 1
Elected Governing Body's Priority for Storm Hazard in Comparison With Other Local Isssues

	Frequency	Percent
Very High Priority	68	16.3
High Priority	126	30.2
Medium Priority	108	25.9
Low Priority	85	20.4
Very Low Priority	30	7.2
N=417		

Thus, in apparent contrast to much of the recent natural hazards literature, a substantial percentage of coastal localities consider the storm threat of high importance as compared with other local issues. A partial explanation for this is, of course, seen in the nature of the population. These are coastal areas where the full force of coastal storms is felt and where people have the most to lose (i.e. where the risk to life and property is greatest) should a hurricane or severe storm occur.

Mitigation Programs and Their Effectiveness

The survey asked about storm hazard reduction strategies and about the use of programs to alter the coastal environment, to strengthen buildings and facilities, and to manage development. Respondents described and ranked these approaches and evaluated their effectiveness.

Explicit Storm Hazard Reduction Strategies

Respondents were asked if their locality had adopted an explicit storm hazard reduction strategy

in addition to their participation in the National Flood Insurance Program. Surprisingly, about half (51%) of the respondents indicated that an explicit strategy did exist. Those who indicated they had such a strategy were asked about specific strategy objectives. Ten objectives were listed in the questionnaire with respondents permitted to circle as many objectives as were applicable. The two most frequently selected objectives (by about 60% of the respondents in each case) were: conserving the protective features of the natural environment and increasing the ability of private structures and facilities to withstand storms. The two objectives most closely related to development management also received a high percentage of responses: guiding new development into less hazardous areas and locating public facilities in less susceptible areas. (Table 2). The lowest ranked objectives were relocation, either of private or public structures and facilities.

Table 2
Objectives of Storm Hazard Reduction Strategy*

Rank Order	Frequency	Percent
1. Increasing ability of private structures and facilities in hazardous areas to withstand storm forces	127	59.9
2. Conserving protective features of the natural environment (e.g. dune protection)	126	59.4
3. Increasing evacuation capacity	99	46.7
4. Increasing ability of public structures and facilities in hazardous areas to withstand storm forces	98	46.2
5. Locating new public facilities and structures in areas less susceptible to storm hazards	96	45.3
6. Guiding new private development into areas less susceptible to storm hazards	96	45.3
7. Provision of adequate storm shelters	82	38.7
8. Structurally-altering and/or reinforcing the coastal environment (e.g. seawalls, bulkheads)	74	34.9
9. Relocation of existing public facilities and structures into less-hazardous areas	14	6.6
10 Relocation of existing private development into less hazardous areas	11	5.2

N=212
*Respondents were asked to check all relevant categories

Programs to Structurally Alter the Coastal Environment

Programs which structurally modify or alter the coastal environment include sand trapping structures (e.g. groins, jetties), sand moving programs (e.g. beach nourishment, beach scraping), shoreline protection works (e.g. bulkheads, seawalls, revetments), and flood control works (e.g. dikes, channels, retaining ponds) (U.S. Army Corps of Engineers, 1981). Substantial use of each of these approaches was found, although shoreline protection works was a clear leader with more than two-thirds of the responding localities indicating that such measures were in use. The use of sand trapping, sand moving and flood control works was about even, with approximately one-third of the responding localities using them.

Respondents were also asked to evaluate the effectiveness of these programs in reducing local storm hazards. Flood control works and shoreline protection received the highest effectiveness ratings, with the remaining two categories falling considerably behind. Sand trapping structures received the lowest rating even though they were used by almost as many localities as flood control works.

Programs to Strengthen Buildings and Facilities

To strengthen buildings and structures, and the private and public facilities that accompany them, local governments rely on building codes, NFIP requirements, and construction standards. Almost all responding localities had a building code in place (90%) and had met the minimum elevation and floodproofing standards required by FEMA under the provisions of the National Flood Insurance Program (94%) (See Conservation Foundation 1980 for a review of NFIP requirements). About 47% of the respondents had special storm resistant building standards in place and well over one-third were floodproofing public facilities and structures. Only 15% of the responding localities, however, had adopted elevation and floodproofing standards which were more stringent than those required under NFIP (Table 3).

modifying the coastal environment

Development Management Measures

"Development management" is defined to include "programs and policies which control or influence the location, density, timing and type of development which occurs in a jurisdiction" (Godschalk, Brower et al 1979; Brower et al 1984 for a review of this concept). Respondents were asked to indicate from a list which development management tools and measures were currently used in their jurisdiction, and the extent to which they serve to reduce local storm hazards.

development management tools

Specific development management measures were organized under six headings: 1) planning; 2) develop-

ment regulation; 3) public facilities policy; 4) taxation, financial and other incentives; 5) public acquisition; and 6) information dissemination. Overall, 21 different measures were listed in this question, ranging from zoning and subdivision provisions to below market property taxes. (Godschalk and Brower, 1985; McElyea, Brower and Godschalk, 1982 for an application of these techniques to hazard mitigation).

strategic placement of capital facilities

Table 3
Programs to Strengthen Buildings and Facilities

	Frequency	Percent	Average Effectiveness (on a five-point scale)
1. Minimum elevation and flood-proofing under NFIP	394	93.8	3.86
2. Building code	378	90.0	3.6
3. Special storm-resistant standards	198	47.1	3.82
4. Floodproofing of public facilities and structures	161	40.2	3.47
5. More extensive elevation and floodproofing	62	14.8	3.94

N=420

Most local governments are using some form of development management. More than seventy percent of the respondents have six or more techniques currently in use (Table 4). About 15% have eleven or more of these measures in use. The majority of localities, roughly 55%, fall within the 6 to 10 measure range.

the popularity of zoning and subdivision regulations

The most popular measures in use include zoning, subdivision regulations, and planning. Table 5 lists the development management techniques in order of frequency selected by respondents.

Development regulation includes traditional land use controls, particularly zoning and subdivision regulations. These two measures are currently in use in most responding localities, including 87% for zoning and 85% for subdivision regulations. Approximately half of the respondents have shoreline setback provisions, while over one-third have dune protection and over a quarter have special hazard area ordinances.

Table 4
Number of Development Management Measures in Use

Number	Frequency	Percent
1–5	121	29.2
6–10	229	54.5
11–15	58	13.8
Over 15	7	1.7

N=420

Under **planning instruments**, the comprehensive or land use plan was the most frequently used (84%). Evacuation plans ranked second in frequency at 66%, while the capital improvements program ranked third, with about half the respondents indicating its use. Not surprisingly, plans and policy documents dealing specifically with the reduction of storm hazards were considerably fewer in number. About 19% of the respondents had hurricane/storm components in their comprehensive plans and about 21% had recovery/reconstruction plans or policies.

Public facility policies concerning the construction and location of facilities, structures and other public investments can be an important means of controlling development. Forty-six percent of the respondents noted that their locality had policy in place to locate public structures and buildings in low risk areas; 31% indicated that their locality attempts to discourage development in high hazard areas through the strategic placement of capital facilities. Unlike the more general techniques, these capital facilities approaches are explicitly storm hazard related.

Three types of measures were included under the heading of **taxation and financial incentives**: reduced or below market taxation, impact taxes or special assessments, and devices for the transfer of development potential. Each of these measures was specifically related to the mitigation of storm hazards. Perhaps due to the narrowness of the definition, relatively few respondents said they are using these techniques for such purposes. Impact taxes/special assessments received the smallest number of responses (2%), followed by reduced or

below market taxation (11%). Development potential transfer measures were more popular, being used by 22% of respondents.

An effective approach to storm hazard mitigation is **public acquisition** of undeveloped land in high hazard areas, preempting its availability for private development. One option is to purchase the fee-simple title for the land (all the rights to the land), while another option is to purchase only the "development rights" to this land (an easement restricting development). The former is a more traditional approach and 29% of the respondents indicated that such an approach was in use, compared with 14% using the second approach – the purchase of development rights or easements in high hazard areas. Very few were using programs to purchase damaged buildings and structures in hazard areas (3%) or programs to relocate structures outside of hazard areas (2%).

public purchase of development rights

Models of rational behavior suggest that individ-

Table 5
Development Management Measures in Order of Frequency Used

Rank Order	Type of Measure	Number of Survey Communities Using It	Percent
1	Zoning ordinance	368	86.6
2	Subdivision ordinance	359	85.5
3	Comprehensive/land use plan	352	83.8
4	Evacuation plan	278	66.2
5	Shoreline setback regulation	225	53.6
6	Capital improvement program	222	52.1
7	Location of public structures and buildings to reduce storm risks	193	46.0
8	Dune protection regulations	159	37.9
9	Location of capital facilities to reduce or discourage development in high hazard areas	131	31.2
10	Acquisition of undeveloped land in hazardous areas	121	28.8
11	Special hazard area ordinance	109	26.0
12	Hazard disclosure requirements in real estate transactions	107	25.5
13	Transfer of development potential from hazardous to non-hazardous sites	89	21.2
14	Recovery/reconstruction plan or policies	88	21.0
15	Hurricane/storm component of comprehensive plan	81	19.3
16	Construction practice seminars	65	15.5
17	Acquisition of development rights or scenic easements	58	13.8
18	Reduced or below market taxation	45	10.7
19	Acquisition of damaged buildings in hazardous areas	14	3.3
20	Building relocation program	9	2.1
21	Impact taxes or special assessments	8	1.9

N=420

Table 6
Development Management Measures in Order of Perceived Effectiveness

Rank Order	Type of Measure	Average Effectiveness Rating (on a five-point scale)
1	Special hazard area ordinance	3.85
2	Impact taxes or special assessments	3.75
3	Dune protection regulations	3.68
4	Location of public structures to minimize risk	3.66
5	Acquisition of undeveloped land in hazardous areas	3.61
6	Shoreline setback regulations	3.59
7	Evacuation plan	3.54
8	Acquisition of damaged buildings in hazardous areas	3.54
9	Transfer of development potential from hazardous to non-hazardous sites	3.44
10	Location of capital facilities to reduce or discourage development in high hazard areas	3.41
11	Hurricane/storm component of comprehensive plan	3.34
12	Building relocation program	3.33
13	Construction practice seminars for buildings	3.22
14	Zoning ordinance	3.15
15	Subdivsion ordinance	3.06
16	Reduced or below market taxation	3.02
17	Recovery/reconstruction plan or policies	2.99
18	Comprehensive/land use plan	2.94
19	Hazard disclosure requirements in real estate transactions	2.92
20	Acquisition of development rights or scenic easements	2.88
21	Capital improvements program	2.55
	N=420	

uals will make responsible decisions if they have access to all the relevant information. This has spurred interest in programs to inform the housing consumer, the developer/builder and the general public about the risks associated with hurricanes and severe coastal storms (e.g. see Palm 1981). Two types of information dissemination programs were investigated: hazard disclosure in real estate transactions and construction practice seminars. About one-quarter of the respondents had hazard disclosure provisions in place, while approximately 15% used construction practice seminars.

construction practice seminars

Table 6 presents rankings of the specific development management measures by their perceived effectiveness at reducing local storm hazards. No planning approaches appear in the top ten in terms of effectiveness at reducing storm hazards. Three regulatory approaches are highly rated: special hazard area ordinances, dune protection regulations, and shoreline setback regulations. Both public facilities policies are perceived to be highly effective, as are programs designed to acquire undeveloped land and damaged buildings in hazardous areas. Impact taxes and programs which transfer development potential from hazardous to non-hazardous sites are also perceived as highly effective. In contrast, among those programs and policies perceived as least effective at reducing storm hazards are the following (the lowest five): capital improvements programs, acquisition of development rights or scenic easements, hazard disclosure requirements, comprehensive/land use plans, and recovery/reconstruction plans or policies.

Ranking Mitigation Approaches

Respondents were asked to rank the importance of the three mitigation approaches in reducing storm hazards in their jurisdiction. Of the three approaches, development management received the most top rankings. Strengthening buildings and facilities received the most second rankings, while structural reinforcement of the coastal environment received the most third rankings (Table 7).

It should be remembered that this ranking is relative to the specific responding locality. That is, even in circumstances where development management is ranked third (last) by a respondent, the locality still may have a solid and innovative development management program. Its lower ranking may be attributable, for instance, to the importance of structural improvements (e.g., in the case where a large amount of the hazard area has already been developed.)

Overall Effectiveness

After considering all of the strategies and techniques employed in their jurisdictions, respondents rated the combined effectiveness of these at reducing local storm hazards. Most felt that local programs were at least partially effective. Over 70% believed their combined programs were either moderately effective or very effective, while only a small 6% believed these programs were not effective at all. The majority of respondents (58%) placed their jurisdictions in the "moderately effective" category. Thus, in most responding areas, room for increased effectiveness exists (Table 8).

Feasibility of Enactment and Enforcement

A primary objective of the survey was to obtain insights into factors which influence the political feasibility of development management. Of eleven possible obstacles to the enactment of development management measures, the following five were most frequently identified, with each chosen by nearly seventy percent of the respondents: 1) the general conservative attitude toward government control of private property rights; 2) a general feeling that the community can "weather the storm"; 3) lack of adequate financial resources; 4) the existence of more pressing local problems and concerns; and 5) the opposition of real estate and development interests. In addition, the absence of politically-active individuals and groups advocating hurricane/storm mitigation, while not as frequently selected, was ranked as an important obstacle.

Respondents were also asked to review several popular arguments against development management and to indicate the extent to which these have been important in their localities. One important argument against the enactment of development management identified by respondents is that such measures lead to increased development costs. Other arguments which were deemed important suggested: 1) decisions about risks from coastal storms are best left to the individual; 2) development management measures will dampen the local economy; and 3) particular development management measures are illegal or unconstitutional.

Table 7
Ranking of the Mitigation Strategies Based on Overall Importance in Reducing Local Storm Hazard

	Rankings		
	Most Important 1	2	Least Important 3
1. Structural reinforcement of coastal environment N=397	87 (21.9%)	118 (29.7%)	192 (48.4%)
2. Strengthening buildings and facilities N=398	103 (25.9%)	185 (46.5%)	110 (27.6%)
3. Development management N=403	215 (53.4%)	90 (22.3%)	98 (24.3%)

the effectiveness of combined programs

The survey also sought to determine whether problems exist in implementing and enforcing those development management measures in place. About half the respondents (49%) indicated that they had encountered implementation or enforcement problems. Of these respondents, the most frequently identified type of problem was that of insufficient funds. Public opposition, lack of support by public officials, lack of qualified personnel, and an insufficient data base were also indicated as problems by a significant portion of the respondents. Moreover, approximately one-third of the respondents (33%) indicated that their localities had experienced negative consequences as a result of development management programs. The most frequent selection by an overwhelming margin was an increase in construction costs.

opposition to development management

Analysis of Relations

From the information contained in the questionnaire, simple bivariate relationships were analyzed

Table 8
Overall Effectiveness of Storm Mitigation

	Frequency	Percent
1. Very effective	50	12.6
2. Moderately effective	231	58.0
3. Slightly effective	93	23.4
4. Not effective	24	6.0
N=398		

relationship between factors affecting mitigation strategies

to provide clues about interactions between coastal development patterns, political feasibility of mitigation measures and perceived effectiveness of these programs at reducing storm hazards. While this analysis is preliminary, several interesting relationships emerged:

- The extent of the coastal floodplain developed appears to be positively influenced by the extent of the locality's area lying in the floodplain and the scarcity of hazard-free development sites. Also, where an agricultural economy still exists, development in the floodplain is likely to be less substantial.
- Adoption of an explicit storm hazard mitigation strategy is positively related to the priority given to the storm hazard by the local governing body, the percentage of a locality's land in the coastal floodplain, and the proportion of local development occurring in these hazard areas.

feasibility of mitigation

- About 60% of the respondents indicated that their localities had experienced a hurricane or severe storm since 1970. This past storm experience appears to be positively associated with the adoption of explicit storm hazard reduction strategies and development management measures.

raising the awareness of local officials

- The quantity of new development, as measured by building permit data, is positively associated with the adoption of explicit hazard reduction strategies and development management measures.
- Population size and number of planning personnel are positively associated with the adoption of explicit hazard reduction strategies and development management measures.
- An active role of regional agencies in storm hazard mitigation is positively associated with the adoption of explicit hazard reduction strategies and development measures.
- The overall effectiveness of storm hazard mitigation programs, including development management, is positively associated with priority given to the storm threat, and negatively associated with a lack of support by public officials. As well, areas that have explicit storm hazard reduction strategies are more likely to have effective storm hazard management programs.
- Knowledge of sources of state assistance is positively associated with the effectiveness of development management measures.

Implications for planning

The preliminary survey findings suggest a number of implications for coastal planners and policymakers concerned with enacting and implementing development management measures to reduce storm hazards. Many factors and community characteristics affect the feasibility of hazard mitigation. Some are beyond the control of planners, while others are more accessible to influence. Even though planners can do little to change the fixed factors, they must be aware of these constraints when designing their programs.

Obviously, mitigation measures will be more feasible in localities where higher priority is given to storm hazards. Planners can heighten awareness of the severity and potential destructiveness of storm forces, both on the part of the general public and local elected officials. They can connect concern over hurricanes with planning and development solutions. Since mitigation efforts tend to be more feasible in localities which have had recent experiences with hurricanes and severe coastal storms, planners can highlight the storm histories of their jurisdictions.

Mitigation programs are more feasible in localities of larger population size, and with greater planning resources and personnel. While these factors may be largely beyond the control of local planners, higher levels of government may be able to influence them. State grants which support the preparation of land use plans and/or which allow funds for technical assistance have enhanced many states' local planning capacity. Regional agencies can also be used to supplement local personnel, resources and planning expertise. In many states, regional agencies have been instrumental in raising the awareness of local officials and the coastal public concerning storm hazards.

Wilmington Star News

A locality's physical characteristics and development patterns present both mitigation opportunities and mitigation constraints. Keeping development away from hazard areas will tend to be more feasible in localities where viable non-intensive uses for these areas, such as agricultural activities, still exist. As well, development pressures in hazard areas will tend to be greater where alternative sites for development are less available. In many circumstances it simply may not be possible to prevent development in hazardous areas without entirely stopping development in the locality.

Storm hazard priority is also affected by physical characteristics and patterns of development. Where the hazard area comprises a larger portion of the locality, and where a high degree of development is already occurring in the hazard zone, storm hazard priority is enhanced. In these situations, the potential destructiveness of storms is harder to ignore. The finding, which shows that the use of development management is greater where development pressures are more extensive, supports this. It suggests moreover, a kind of "tipping-point" theory about the use of development management. The need for management programs may not exist until a critical level of development occurs. The trick for planners and policymakers concerned about mitigation, then, is to employ development management tools before the extent and pace of hazard zone development forecloses any possible future reduction in coastal damages and loss of life.

political constraints to mitigation

The survey results also indicate the importance of political constraints to mitigation, including the opposition of real estate and development interests, and the absence of politically-supportive groups. Planners must begin to work with real estate, business and other politically important groups in the locality to inform them of the benefits of mitigation. Planners may also need to nurture and develop other local constituencies that will be politically supportive of mitigation efforts. Recreation and conservation groups, for example, may represent potent political allies in the support of mitigation programs. The importance of combining storm hazard reduction with other salient local goals cannot be overstated.

overcoming local political opposition

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Coastal setbacks is another tenable means of development management. Coastal setbacks can assure protection of beach access and continued development of the local economy in addition to reducing flood damages. Local planners must begin to capitalize upon this "strategic dovetailing" of local concerns.

intergovernmental approaches

Higher levels of government, and particularly states, may play an important role in assisting planners and policy makers in overcoming local political opposition to hazard mitigation. The North Carolina coastal management program now requires coastal jurisdictions to develop hurricane mitigation and post-storm reconstruction plans as part of their local land use plans. This type of extra-local requirement deflects political opposition from the local to the state level, and allows local supporters to point to state requirements for justification and support for local efforts.

comprehensive and effective storm hazards mitigation program

The importance of particular arguments against the use of development management is also apparent from the survey. This strongly suggests the need for local planners to be able to explicitly address and respond to these challenges. Mitigation proponents should not permit arguments against the legality or constitutionality of a proposed development management measure, for example, to jeopardize its adoption and effective implementation. Planners should be prepared to respond knowledgeably and authoritatively to these arguments in order to inspire a more comprehensive and effective storm hazards mitigation program for high risk coastal area.

NOTES

1. See Beatley, Brower, Godschalk and Rohe, 1985, for a complete review of the findings of the questionnaire. This report can be obtained by writing to the Center for Urban and Regional Studies, 108 Battle Lane, Chapel Hill, N.C. 27514.
2. These were communities for which an additional wave height (under a new methodology) had been or was in the process of being computed. As a further check, NFIP State coordinators in every surveyed state were asked for an independent list of localities with V-zones in their states. Because we felt that very small coastal localities were unlikely to be undertaking development management programs, localities of less than 1,000 population (as of the 1980 census) were not surveyed.
3. A follow-up to non-responding localities allowed us to eliminate 15 localities without coastal storm hazards, bringing our overall survey population to 621, and increasing the final response rate to about 68%.

REFERENCES

Beatley, Timothy, David J. Brower, David R. Godschalk, and William M. Rhoe. 1985. *Storm Hazard Reduction Through Development Management: Results of a Survey of Hurricane-Prone Localities in Nineteen Coastal States.* Chapel Hill, N.C.: University of North Carolina, Center for Urban and Regional Studies, January.

Brower, David J., Candace Carraway, Thomas Pollard, and C. Luther Propst. 1984. *Managing Development in Small Towns.* Chicago: APA Planners Press.

Conservation Foundation. 1980. *Flood Hazard Management and Natural Resource Protection,* Washington, D.C.: Prepared for FEMA, October.

Drabek, Thomas, Alvin Mushkatel and Thomas Kilijanek. 1983. *Earthquake Mitigation Policy: The Experience of Two States.* Boulder, CO: Institute of Behavioral Science, University of Colorado.

Godschalk, David R. and David J. Brower. 1985. "Mitigation Strategies and Integrated Emergency Management," *Public Administration Review,* Vol. 45, January, pp. 64–71.

Godschalk, David R., David J. Brower et. al. 1979. *Constitutional Issues of Growth Management.* Chicago: Planners Press, 1979.

McElyea, William D., David J. Brower and David R. Godschalk. 1982. *Before the Storm: Managing Development to Reduce Hurricane Damages.* Chapel Hill, N.C.: University of North Carolina, Center for Urban and Regional Studies.

Rossi, Peter, James Wright and Eleanor Weber-Burchin. 1982. *Natural Hazards and Public Choice: The State and Local Politics of Hazard Mitigation.* Academic Press.

U.S. Army Corps of Engineers. 1975. *Guidelines for Identifying Coastal High Hazard Zones.* Galveston District.

U.S. Army Corps of Engineers. 1981. *Low Cost Shore Protection: A Guide for Local Government Officials.* Washington, D.C. 1981.